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ABSTRACT

The purpose of this study was to determine which types of feedback had the most influence on the revisions of instructional materials performed by writers in an individualized science curriculum development project. Each of the Individualized Science Instructional System (ISIS) project staff members, whose job was to revise minicourse drafts produced and field-tested by the ISIS project, participated in an evaluation of the types of feedback that may have influenced their revisions of ISIS minicourses. They rank-ordered a list of types of feedback according to the amount of influence the feedback had on their actual revision of minicourse materials. Verbal (audiotaped) feedback from teachers was rated as the most influential by nearly all of the subjects. Feedback that involved information obtained from students who used the instructional materials received the lowest ratings. Informal and verbal (i.e., nonquantitative) feedback was rated as being more influential than feedback that was more formal and less verbal (i.e., quantitative). (Author/MLH)

# The Effects of Various Formative Evaluation Procedures on Instructional Material Revision in a Large Scale Individualized Science Curriculum Development Project*

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Educational researchers involved in the formative evaluation of instructional materials are typically faced with the problem of trying to collect information or provide experiences that will be relevant to those persons who will use the information or experiences to help them improve instructional products. It is not surprising, then, that this problem had to be faced by the evaluation staff of the Individualized Science Instructional System (ISIS). Our staff established several formative evaluation procedures which were designed to provide revisors of the instructional materials with experiences and information that would have a desirable influence on their revision of ISIS materials.

It was not, however, until these formative evaluation procedures were put into operation that the following question could be asked: *"Which types of feedback had the most influence on the revisors of these instructional materials?"* The remainder of this paper will describe a procedure that was used to answer the above question. It will also describe

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the several types of feedback that were made available to these instructional material developers.

A brief description of the ISIS Project is given below. The reading of this description may be omitted by those persons who already are familiar with ISIS. The description, written by the Project Director, Dr. Ernest Burkman, is taken from the "FOREWORD" of each ISIS module.

> Evidence has been mounting that something is missing from secondary science teaching. More and more, students are rejecting science courses and turning to subjects that they consider to be more practical or significant. Numerous high school science teachers have concluded that what they are now teaching is appropriate for only a limited number of their students.
>
> As their concern has mounted, many science teachers have tried to find instructional materials that encompass more appropriate content and that allow them to work individually with students who have different needs and talents. For the most part, this search has been frustrating because presently such materials are difficult, if not impossible, to find.
>
> The Individualized Science Instructional System (ISIS) project was organized to produce an alternative for those teachers who are dissatisifed with current secondary science textbooks. Consequently, the content of the ISIS materials is unconventional as is the individualized teaching method that is built into them. In contrast with many current science texts which aim to "cover science", ISIS has tried to be selective and to limit our coverage to the topics that we judge will be most useful to today's students.
>
> Obviously the needs and problems of individual schools and students very widely. To accommodate the differences, ISIS decided against producing tightly structured, pre-sequenced textbooks. Instead, we are generating short, self-contained modules that cover a wide range of topics. The modules can be clustered into many types of courses, and we hope that teachers and administrators will utilize this flexibility to tailor-make curricula that are responsive to local needs and conditions.
>
> ISIS is a cooperative effort involving many individuals and agencies. More than 75 scientists and educators have helped to generate the materials, and hundreds of teachers and thousands of students have been involved in the project's nation-wide testing program. All of the ISIS endeavors have been supported by generous grants from the National Science Foundation. We hope that ISIS users will conclude that these large investments of time, money, and effort have been worthwhile.

FEEDBACK PROCEDURES

During the 1974-1975 school year various feedback procedures were employed by the evaluation staff of the ISIS Project. Several of these procedures involved approximately 50 schools, 100 teachers, and 6000 students who participated in the evaluation of 24 trial-draft edition ISIS minicourses. Other feedback procedures involved only project staff members or outside consultants. In all, ten major feedback procedures were identified and evaluated in this study. Each of these procedures is described, briefly, below.

1. The revisors' visits to classes using the trial materials.

Minicourse writer-revisors visited a limited number of classrooms that were using materials developed by the ISIS staff. They observed teachers and students using these instructional materials and discussed their good and bad points with them.

2. Reviews by "content experts".

The writer-revisors were provided with content reviews of the materials that were made by experts in the field who were not associated with the ISIS Project. Often the revisors would consult with the reviewer (by phone) to insure that the content of any revised material was scientifically accurate and up to date.

3. Suggestions from other writer-revisors.

ISIS writer-revisors did not work in isolation. Numerous formal and social meetings gave revisors an

opportunity to exchange ideas about materials they were working on as well as to offer suggestions that might benefit others in their revision tasks.

4. Suggestions from the Project Director or Associate Directors.

This is a type of feedback that cannot be ignored in a large scale project such as ISIS. The revisors frequently received both verbal and written instructions and suggestions from these Directors.

5. Audio-taped comments from teachers who used the trial materials.

ISIS has eight trial centers located throughout the country. On a regular basis teachers within each center gather for a meeting, part of which is devoted to the production of audio-tapes of discussions about minicourses they have tried. These feedback tapes are then forwarded to ISIS Project headquarters where they are listened to by the appropriate minicourse revisors.

6. Comments written by teachers in trial edition booklets.

Revisors were provided with a compilation of page by page comments written by teachers directly on the materials they had tried. These annotated pages pointed out pictures, figures, words, sentences or whole sections of instruction that caused unnecessary problems for students. Teachers also wrote on these pages suggestions for improvement of the materials.

7. Teachers' written responses to questionnaire items.

For each minicourse, teachers were asked to write responses to about ten open-ended questions that were designed to obtain feedback about specific items in that particular minicourse. These questions covered such things as specific problems with experiments, instructional games or audio-tapes that were part of the minicourse, the items of the minicourse test, the required activities in the minicourse, and the types of students who benefitted most or least from the minicourse. Written responses by all teachers were typed, compiled, and provided to revisors.

8. Students' responses to feedback questionnaire items.

Each student who used ISIS trial version minicourses provided a detailed record of what he or she did in a particular minicourse and also recorded his or her attitudes toward each activity within the minicourse. The students recorded their data in response to daily multiple choice questions on machine scorable sheets which were read and computer processed. This procedure enabled each revisor to be provided with an activity by activity breakdown of a minicourse in terms of the percentage of students who did the activity, how many found the directions confusing, how many had difficulties with materials or equipment or the reading level, how much of each activity students did, how much time students spent on an activity, whose help students needed to get through the

activity, and how interesting students found the activity. In addition, the revisor was provided with data regarding students' overall ratings and reactions to the minicourse as well as background information on the students who provided this feedback data.

9. Students' test results.

A minicourse revisor was provided with several analyses of students' performance on the minicourse test. Pretest and posttest item analyses were provided for all test items covering the "Core" section of the minicourse. The ISIS Instructional Model holds all students responsible for mastering the Core Objectives in a minicourse. Although students are allowed to skip any Core Activities for which they have already mastered the corresponding objective, they are required to answer all Core test items. Therefore, the revisor was provided with data comparing the performance on each test item of students who did the Activity with the performance of those students who skipped the Activity. Ideally, students who justifiably skip a Core Activity should do as well on the corresponding test item as those students who did the Activity.

10. The revisors' examination of copies of booklets used by students.

A revisor was also provided with a random sample of minicourse booklets used by students in each ISIS trial classroom. Since students wrote out their responses to

text-embedded questions or problems directly in the trial edition booklets, an examination of these responses allowed the revisor to pinpoint areas of instruction that were not being understood by students. Many students also wrote comments in their books describing their likes and dislikes about the minicourse booklet.

## METHOD

Each of seven ISIS project staff members whose job it was in the summer of 1975 to revise minicourse drafts produced and field-tested during the previous school year participated in an evaluation of various types of information or experiences that may have influenced their revisions of ISIS minicourses. All seven revisors were experienced developers of instructional materials and all held advanced academic degrees, mostly doctorates. Each subject was given a randomly ordered list of ten different types of feedback that they had made use of (see Appendix A). Independently, subjects rank ordered the ten items on the list to show the comparative influence that the items had on their actual revisions of minicourse materials.

## RESULTS AND DISCUSSION

The rank order that each of the seven revisors gave to the ten items (A-J) is shown in Table 1.

TABLE 1

Rank Orders of Influence Given by Seven Revisors to Ten Feedback Procedures*

| Revisor: | PROCEDURE A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| #1 | 3 | 6 | 1 | 8 | 7 | 10 | 5 | 4 | 2 | 9 |
| #2 | 8 | 2 | 1 | 6 | 9 | 5 | 3 | 4 | 10 | 7 |
| #3 | 5 | 4 | 1 | 9 | 8 | 7 | 6 | 2 | 10 | 3 |
| #4 | 10 | 2 | 1 | 9 | 4 | 6 | 8 | 3 | 7 | 5 |
| #5 | 6 | 9 | 1 | 7 | 5 | 8 | 10 | 3 | 2 | 4 |
| #6 | 1 | 6 | 3 | 8 | 9 | 7 | 2 | 4 | 10 | 5 |
| #7 | 7 | 3 | 4 | 6 | 9 | 5 | 8 | 1 | 10 | 2 |
| Rank Sum | 40 | 32 | 12 | 53 | 51 | 48 | 42 | 21 | 51 | 35 |

*See Appendix A for a listing of procedures A-J.

To determine the extent to which those seven rank orders tended to agree, Kendall's statistic, the coefficient of concordance, was computed.[1] If the revisors were in perfect agreement in their rank orders, then the variance of the rank sums would be equal to the maximum possible variance of the rank sums and the coefficient would equal 1.0. The coefficient was found to be 0.41. This did not indicate a high degree of concordance among the revisors since the variance of the rank sums was only 41% of the maximum possible variance.

1. William L. Hays & Robert L. Winkler. *Statistics: Probability, Inference, and Decision*. New York: Holt, Rinehart, and Winston, 1971.

The resultant low coefficient, no doubt, was due to the fact that the revisors could not agree on the rank ordering of the four least influential items, D, E, F, and I. These four items had rank sums with a range of only 5 (see Table 1). If each revisor had given exactly the same rank to each of these four least influential items, the range of the rank sums would have been 21 (i.e., a rank sum of 49 for 7 seventh place votes and a rank sum of 70 for 7 tenth place votes) and the variance between rank sums would, likewise, have been much greater.

Despite the low coefficient of concordance, it is obvious from Table 1 that certain feedback procedures exerted considerably greater influence upon these seven revisors than other procedures. Five of the seven revisors ranked item C, the audio-taped comments from teachers, as the most influential of these ten feedback procedures. Item H, the comments by teachers in the minicourse booklets, also was highly influential since all revisors ranked it among their top four choices. Five of the seven revisors ranked item J, the teachers' written responses to questionnaire items, to be among their top five choices. Note that each of these three high ranking items involved procedures that involved feedback from teachers (rather than from students) and that each of these three procedures could be categorized as being verbal and informal (i.e., non-quantitative).

On the other hand, most of the items that were ranked as being least influential involved feedback that came from students. These included the students' test results and their

responses to multiple choice questionnaire items. Both of these procedures were types of feedback that could be categorized as being non-verbal and formal (i.e., quantitative). This is not to say that feedback from students did not influence these writers' minicourse revisions, but instead, that feedback from teachers had a greater influence than feedback from students.

As is typical of most studies, an answer to a researchable question such as the one posed in this paper inevitably leads to additional questions. The results of this study lead one to wonder whether these revisors rated feedback from teachers to be more influential than feedback from students merely because it came from teachers rather than students, or was it more influential because it was more verbal, less formal, and less quantitative than the student feedback data. The answer to this question, though not within the scope of this paper, is a logical goal for further research.

One final note is in order here. The reader should be made aware that the feedback procedures described in this paper were those that were followed in field testing ISIS trial-draft minicourses during the 1974-1975 school year. Since that time feedback from revisors as well as changes in the content and format of minicourses have led to the modification of several of the feedback procedures described in this paper. Studies such as the one described in this paper have contributed information that aided our staff in deciding which feedback procedures could be revised.

APPENDIX A

TO: All ISIS Minicourse Revisors

FROM: J. Ciesla

SUBJECT: How various sources of feedback affect your minicourse revisions.

In an attempt to help me do a study of the comparative influence of the various kinds of feedback information available to you, would you please respond anonymously to the following:

Disregarding your own intuitive feelings toward what should be revised in a given minicourse, and also disregarding the modifications that have been imposed on you due to changes made in the objectives for a given minicourse, please rank in order of decreasing importance the influence that the following randomly ordered list of 10 types of feedback have upon your revisions of ISIS minicourses:

A) Suggestions made to me by the Project Director or Associate Directors.

B) Reviews of the minicourse from "content experts".

C) Audio taped comments from ISIS Trial Teachers.

D) ISIS students' minicourse test results.

E) Examining copies of minicourse booklets used by students.

F) ISIS students' responses to feedback questionnaire items.

G) Suggestions made to me by Project Staff members (excluding Evaluation Staff and Project Administrators).

H) Comments written by ISIS Teachers in minicourse booklets.

I) My own visits to ISIS classrooms.

J) ISIS Teachers' written responses to questionnaire items.

| Rank Order | Letter: |
|---|---|
| (Most Influential) 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| (Least Influential) 10 | |